

AGU Fall Meeting, December 13-17, 2010

Session SH02: Solar Wind Turbulence: Theory, Observations, and Future Mission Concepts

Coherent eigenmodes in homogeneous MHD turbulence

John Shebalin, NASA JSC

The statistical mechanics of Fourier models of ideal, homogeneous, incompressible magnetohydrodynamic (MHD) turbulence is discussed, along with their relevance for dissipative magnetofluids. Although statistical theory predicts that Fourier coefficients of fluid velocity and magnetic field are zero-mean random variables, numerical simulations clearly show that certain coefficients have a non-zero mean value that can be very large compared to the associated standard deviation, i.e., we have coherent structure. We use eigenanalysis of the modal covariance matrices in the probability density function to explain this phenomena in terms of 'broken ergodicity', which is defined to occur when dynamical behavior does not match ensemble predictions on very long time-scales. We provide examples from 2-D and 3-D magnetohydrodynamic simulations of homogeneous turbulence, and show new results from long-time simulations of MHD turbulence with and without a mean magnetic field.